

Trends and Game-Changers in the California Power Market



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Outline



Caveats



Trends



Game-Changers



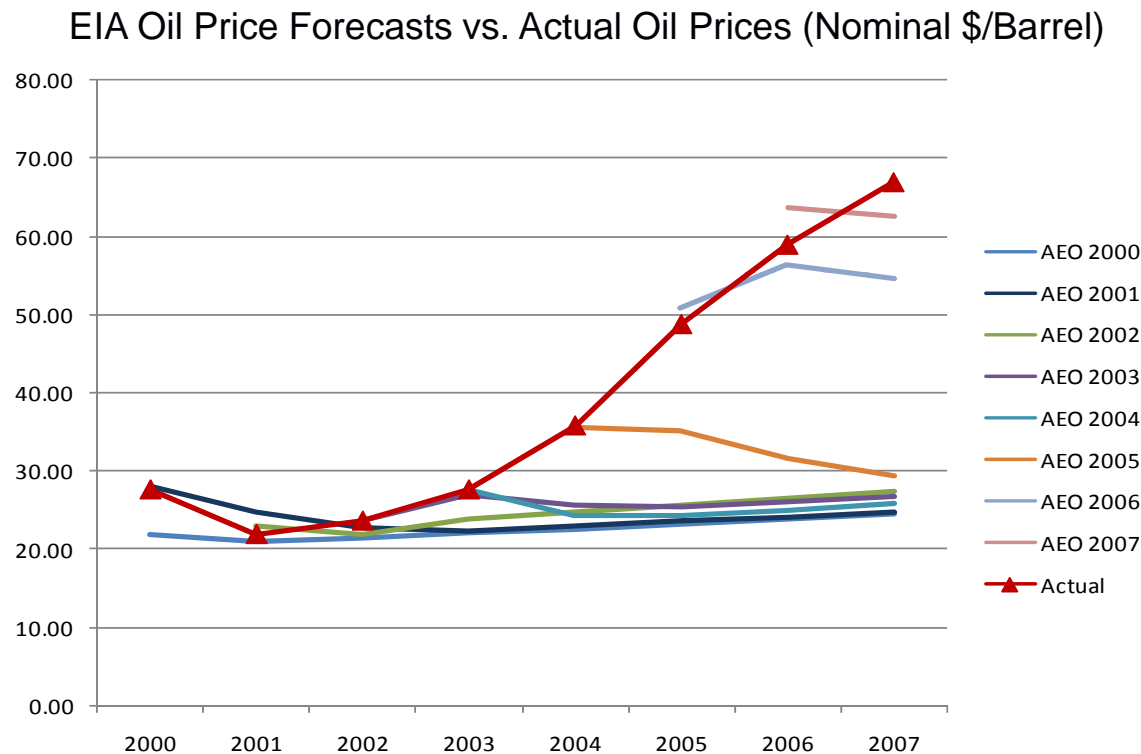
Conclusions



First, a few caveats...



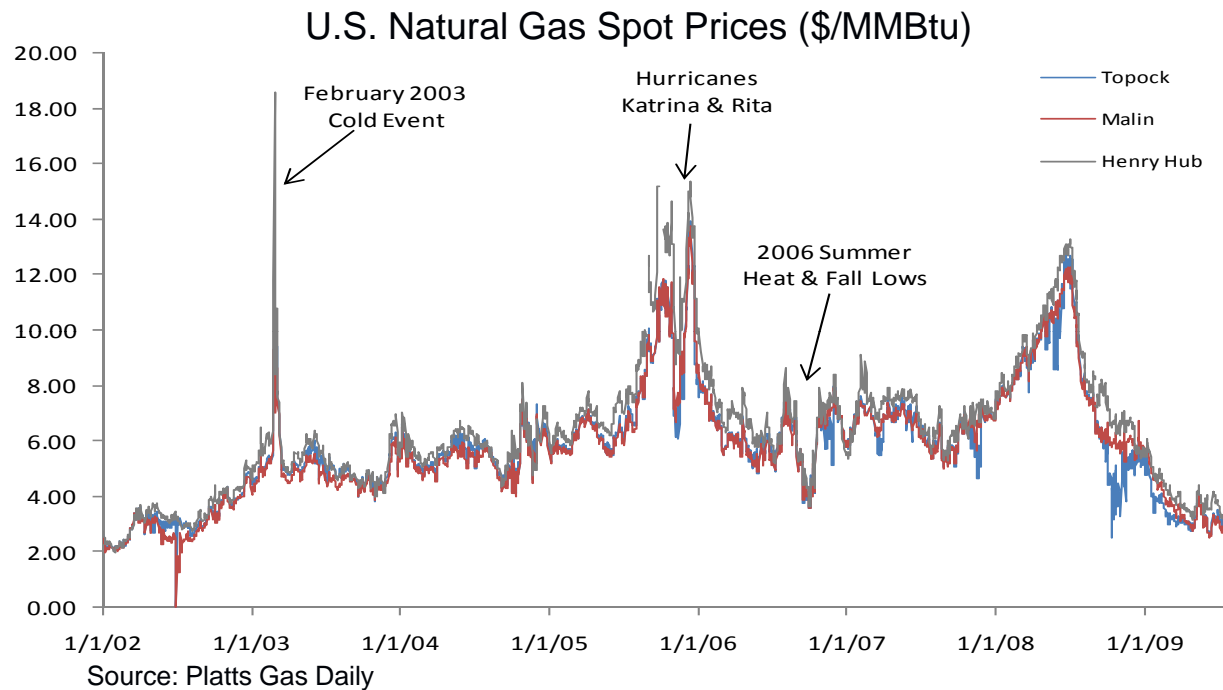
1. Fuel prices are difficult to forecast



Source: EIA AEO Retrospective Review

EIA and others failed to forecast the upward trend in oil prices from 2001-2007.

2. Trends can be disrupted



After Hurricane Katrina, about 85% of total Gulf gas production was disrupted.

Other unanticipated shocks are also sources of disruption.

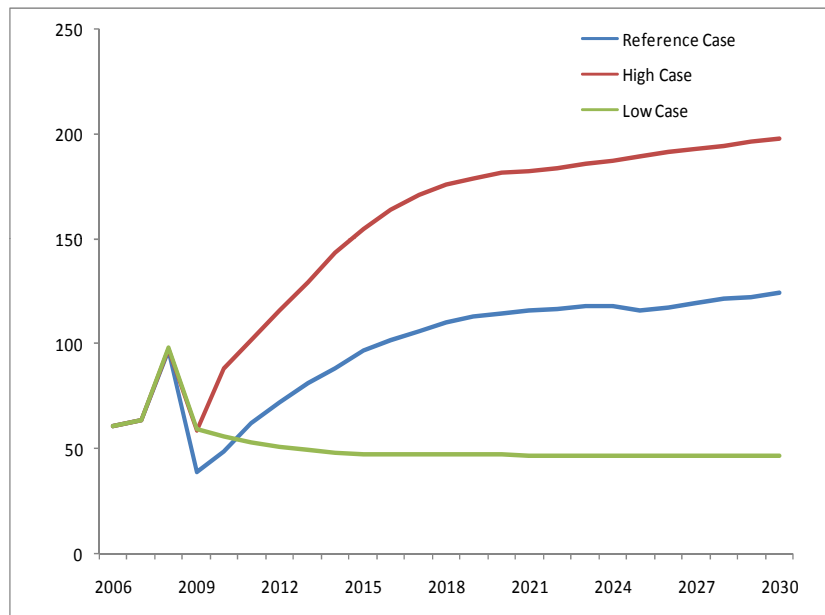


What trends do we see?



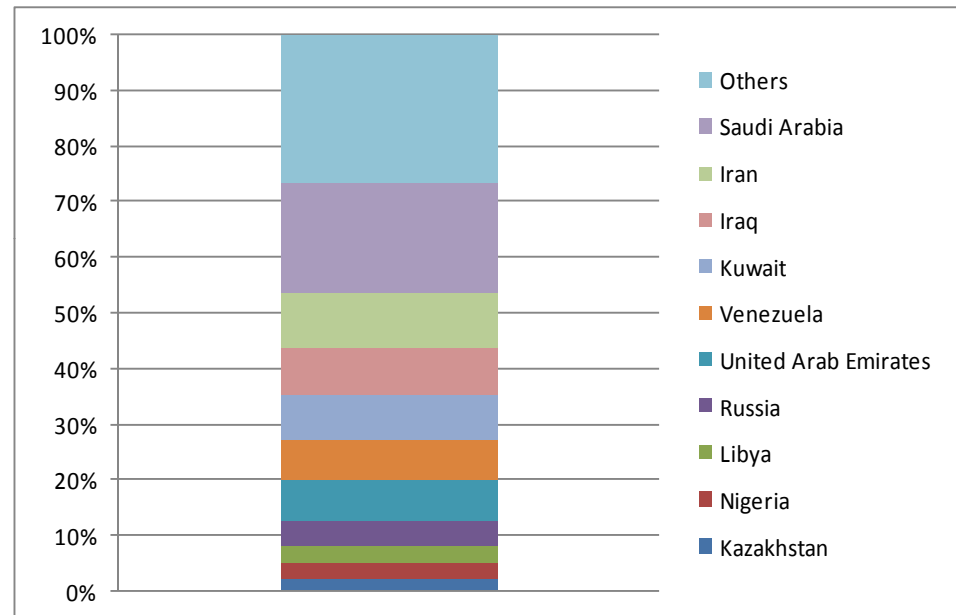
High and volatile oil prices likely to persist

EIA Imported Crude Oil Price Forecast
(2007\$/Barrel)



Source: EIA AEO 2009

World Crude Oil Reserves By Country



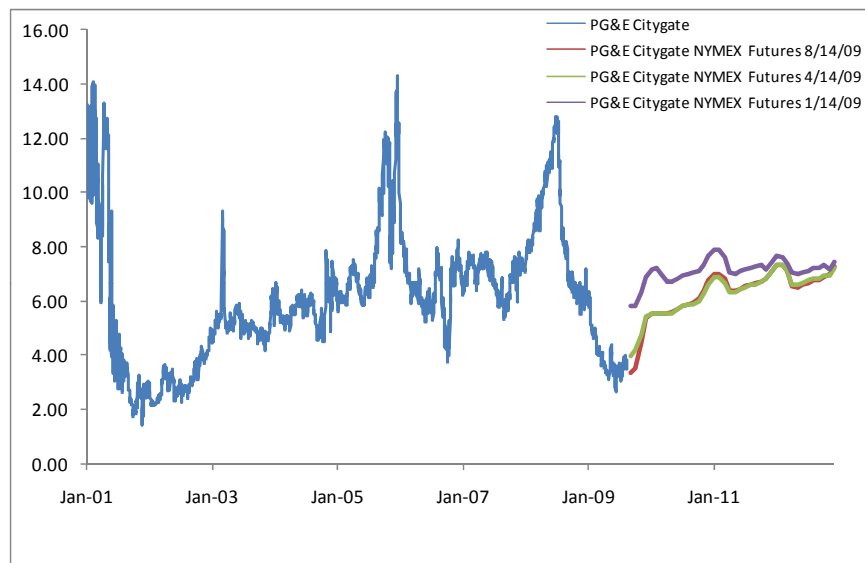
Source: Oil and Gas Journal, January 1, 2009

Important drivers of this trend:

- success/failure of curbing demand in consuming countries, and
- large share of global oil reserves located in politically unstable regions

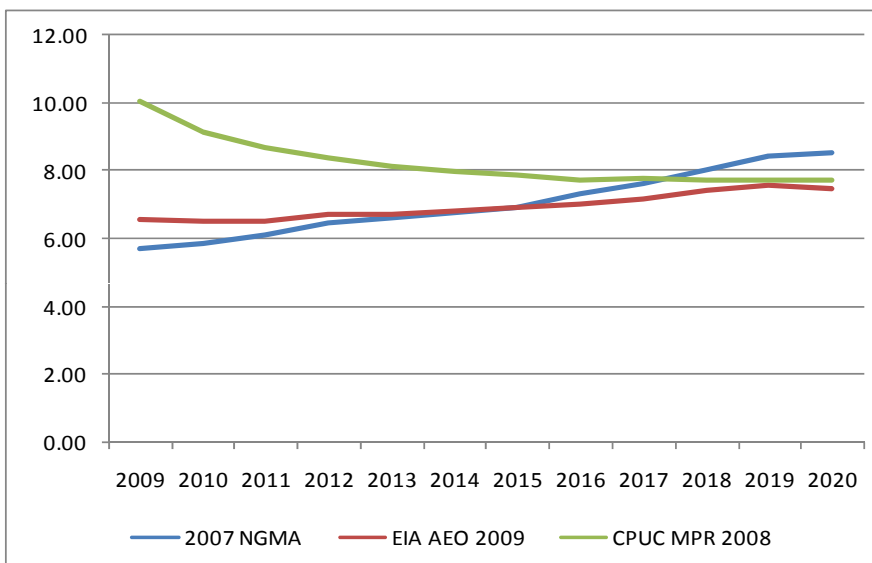
Abundant gas = low(er) prices

PG&E Citygate Gas Prices (\$/MMBtu)



Source: Platts Gas Daily and NYMEX Settlements

Natural Gas Price Forecasts (\$/Mcf)



Source: Roesser, Randy. 2009. "Natural Gas Price Volatility. California Energy Commission." CEC-200-2009-009-SD

Gas storage levels are at or very near the limit.

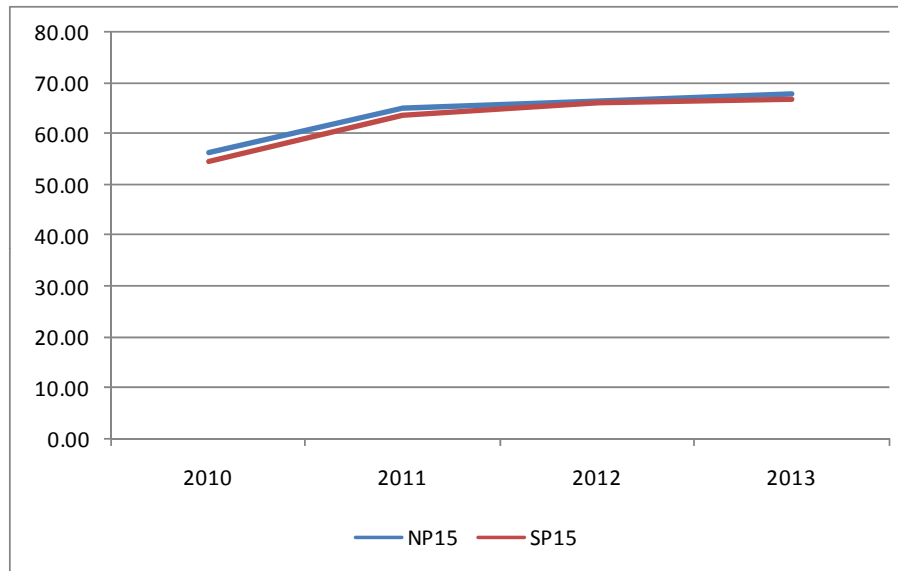
Gas shale production— the fastest growing source of unconventional production— is expected to be 2.71 tcf in 2020.

All three IOUs expect prices to stay under \$8/MMBtu from 2010-2018; one IOU forecast prices to range between \$6 and \$7.*

*Source: Tavaers, Ruben. "Natural Gas Price Forecast and Uncertainty." CEC Joint IEPR and Electricity & Natural Gas Committee Workshop.. June 16, 2009

Power prices stable in near-term

Forecasted Power Prices (\$/MWh)



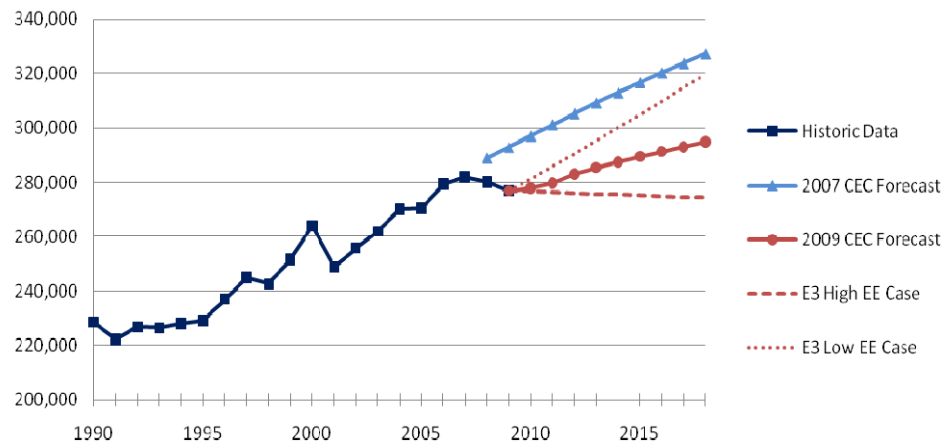
Source: Platts Forward Curve

Low gas prices will help contain power prices, but impact of proposed state and federal greenhouse gas regulations is a significant unknown.

Potential California MRTU Impacts?

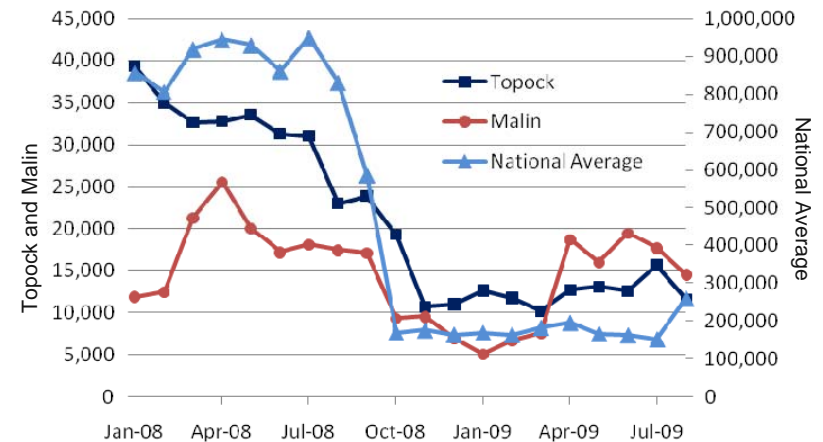
The recession takes a toll on demand

Statewide Consumption (GWh)



Source: CEC "California Energy Demand 2010-2020 Staff Draft Forecast"; E3 GHG Calculator v2b, May 13, 2008

Spot Market Gas Volume (MMBtu)



Source: Platts "Gas Daily" January 1, 2008-August 31, 2009

Projected 2018 electricity consumption down 9% and projected peak demand down 5% in 2009 forecast vs. 2007 forecast.

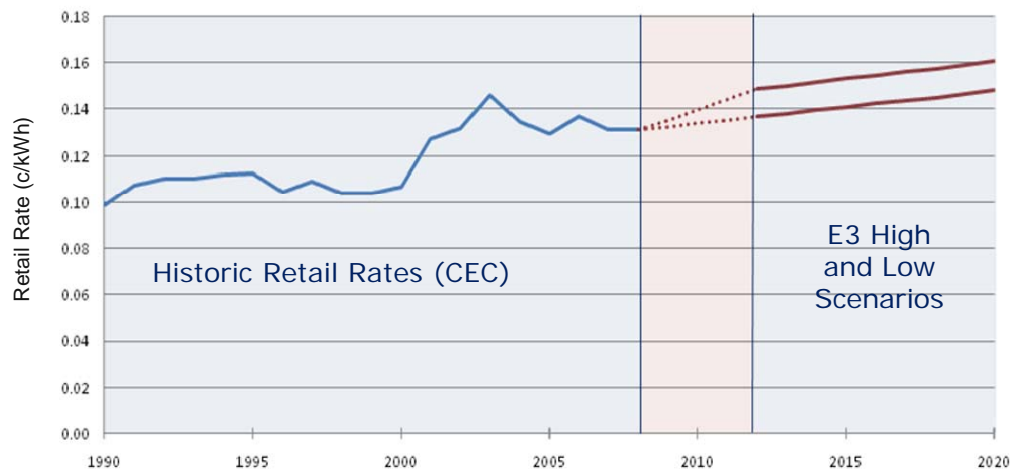
Gas market trading has decreased as much 30-80% relative to 2008. Impacts in Southern California are more severe than Northern California.

Energy efficiency programs are shifting into high gear with uncertain long-term impacts.



Carbon regulation will transform electricity systems

1. Rate Impacts?



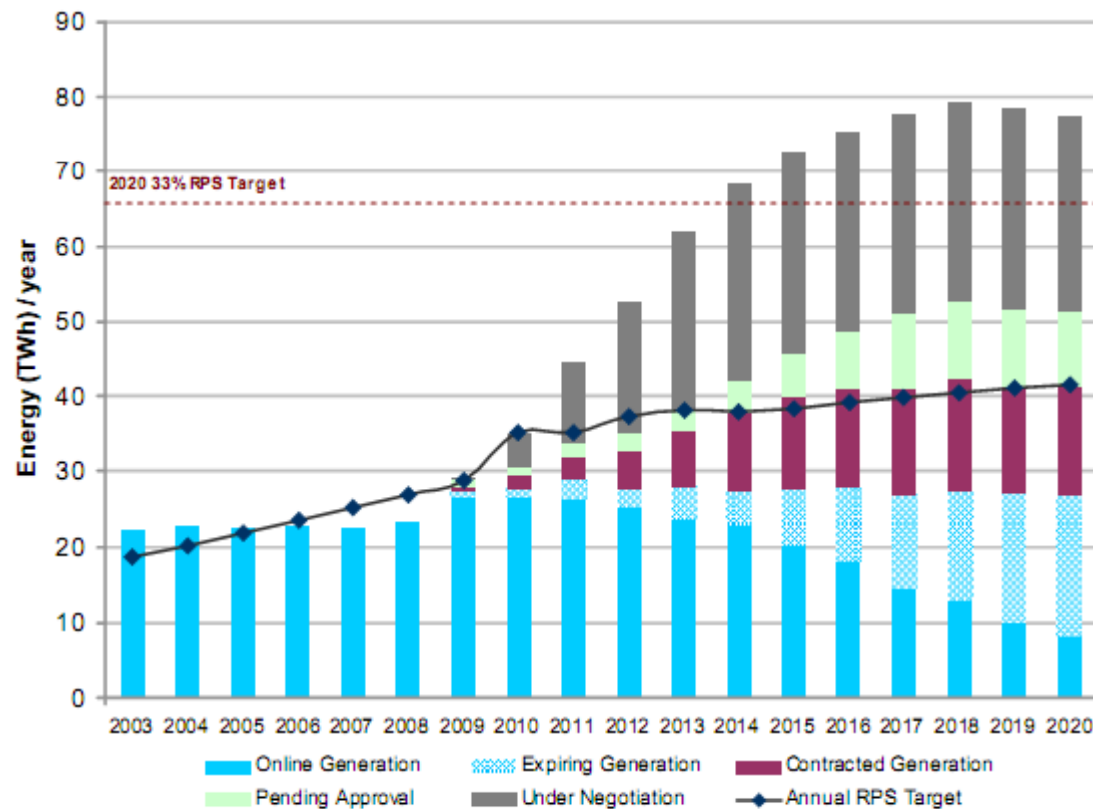
2. Reliance on “negawatts” and renewables



3. Relative costs of different generation technologies

A long march ahead for renewable energy

Actual and Forecasted IOU Renewable Generation



Only 14% of contracted renewable capacity is online.

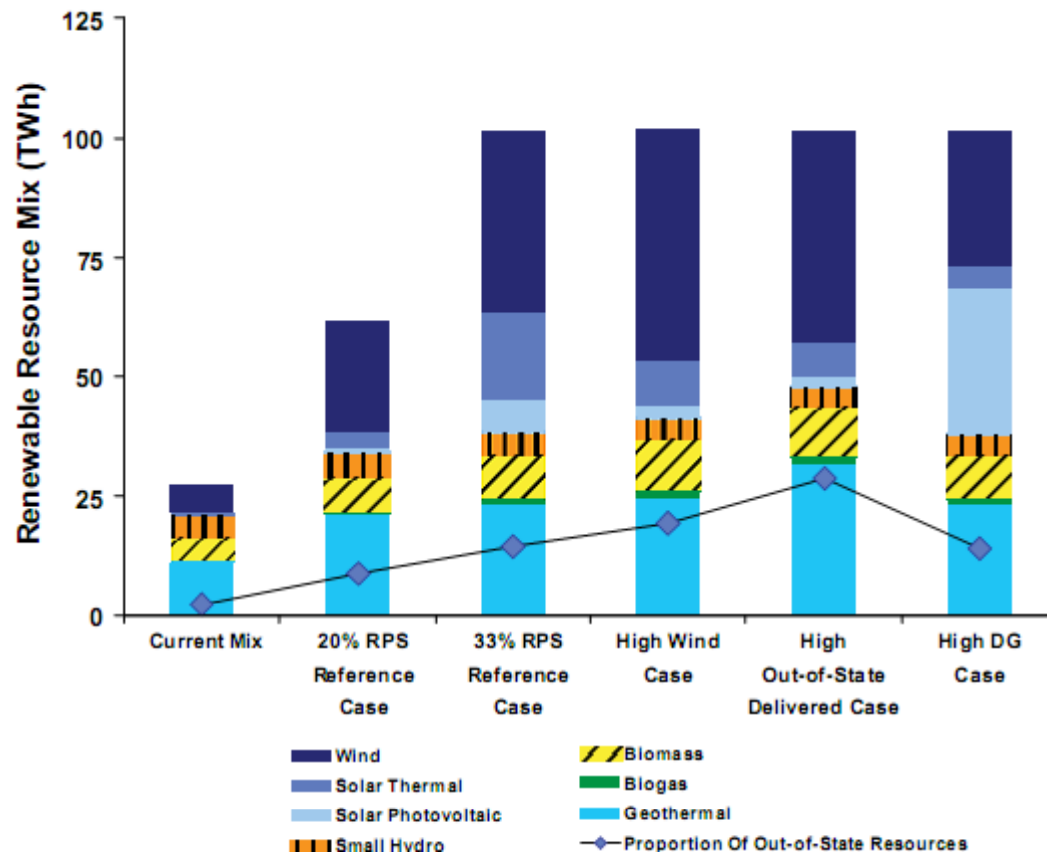
Goal of 33% by 2020 will require significant project development.

Path for 33% achievement depends on technology and transmission.

Source: CPUC "Renewables Portfolio Standard Quarterly Report," July 2009.

Survivor California: who will win immunity?

Potential Renewable Resource Mix



Immunity secrets:

- Stimulus funding to support loss of credit appetite.
- Interconnection queue cluster
- BLM land vs. disturbed land
- Utility scale vs. DG
- In-state vs. out-of-state
- Transmission access and what transmission is built.

Source: CPUC "33% Renewables Portfolio Standard Implementation Analysis Preliminary Results," June 2009.

Need for transmission investment



CPUC 33% Implementation Analysis:

- To meet 20% by 2010 target, need 4 new major transmission lines at a cost of \$4 billion
- To meet 33% by 2020 target, need 7 additional lines at additional cost of \$12 billion

Transmission Projects under Development:

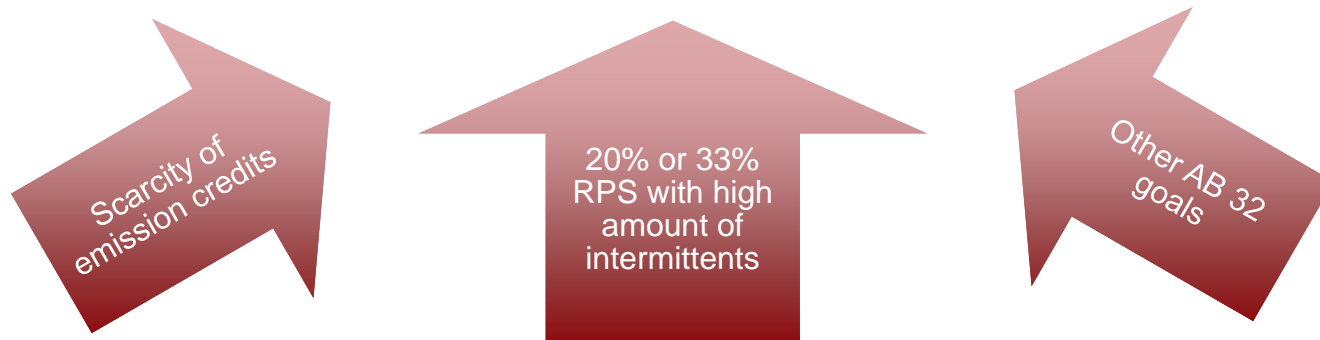
- Tehachapi
- Sunrise
- Southwest Intertie
- C3ETP
- Green Path North
- Devers-Palo Verde #2
- Canada-Northern CA

- **Transmission could be deal maker or deal breaker for generating technologies.**
- **Certainly costly and will face significant siting hurdles.**

A potential stalemate among policies



Location and operational flexibility will be key for thermal assets, but expect depressed operating levels and lower power prices.



Expected Roles for Gas-Fired Generation

Description	Role of Plant
1 Intermittent Generation Support	Support intermittent renewable generation.
2 Local Capacity Requirements	Strategically located generation necessary to mitigate grid problems and potentially reduce need for new transmission infrastructure.
3 Grid Operations Support	Support specific grid operational needs; plant is not necessarily located in a local capacity area.
4 Extreme Load / System Emergencies Support	Meet peak demand under extreme temperature conditions (for example, summer peak demand) or other system emergencies.
5 General Energy Support	To provide a reliable supply of cost-competitive energy to the grid; plant operates primarily based on economic dispatch, can provide energy in low hydro periods, extended nuclear outages, and seasonal low wind periods.

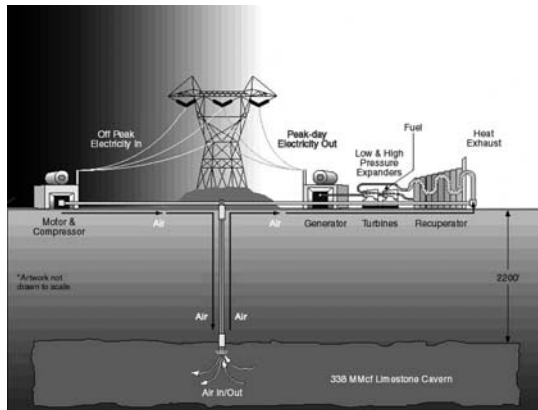
Source: MRW & Associates, "Framework for Evaluating Greenhouse Gas Implications of Natural Gas-Fired Power Plants in California." California Energy Commission. CEC-700-2009-009





Game-Changers

Speed and scale of “enabling technology” deployment



Rapid and widespread adoption of energy storage technologies could bolster major expansion of wind and solar.



Penetration of smart grid technologies all along the electricity “supply chain” could have transformative impact.



Conclusions

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1. Abundant gas supplies and the Great Recession will help to curb power prices in the near and medium term.
2. While California aspires to be the renewable promised land, there are numerous obstacles to converting the megawords into megawatts.
3. Some renewable technologies and some developers will thrive, while others will not survive. Who will be the winners?
4. Natural gas-fired plants will act not only as the marginal suppliers responding to weather and outages, but also to uncertainty in renewable development and performance.
5. The aging gas fleet will be challenged to maintain system reliability in the face of new operating regimes.
6. The resolution of the potential stalemate among conflicting policy objectives and electric system reliability requirements will have implications for infrastructure needs, type, and investments for years to come.

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